REMARKS

Claims 1, 11, and 14 have been amended to include the additional limitations that the thin film resistive element s are "long and narrow" and that the two resistive elements are positioned close enough to each other that the effects of exposure to high and variable temperature fluxes on the resistance of the two elements are identical. Support for these amendments is found in the original specification, for instance at page 3 lines 26-29, page 5, lines 10 and 11, and page 6 lines 8-10 and 28-29, in claim 14, and in the drawings, for instance in Figures 1 to 3 which show spiral conductors that are substantially narrow relative to their length. As such, Applicant submits that the proposed amendments do not constitute new matter.

The Examiner objects to the drawings because "line 3-3" is not shown in Figure 1. A proposed correction to Figure 1 is shown on the attached for review by the Examiner. Pending the Examiner's approval, a new formal drawing including this correction will be submitted. The Examiner also objects to the drawings under 37 C.F.R. §1.83(a), noting that the "zig-zag" of Claim 24 is not shown. Applicant traverses this objection noting that the "zig-zag" pattern is clearly shown in Figure 7. Applicant submits that the drawings are now in condition for allowance.

The Examiner rejects Claims 1, 3/1, 4-7, 14, 20/14, and 21/14 under 35 U.S.C. §103(a) as unpatentable over Rohrback '771. The Examiner also rejects Claims 2, 3/2, and 9 under 35 U.S.C. §103(a) as unpatentable over Rohrback '771 in further view of Rohrback '348 asserting that the resistors 32 and 33 in Rohrback '348 are dimensionally similar and thus suggestive of the use of similar size resistors in Rohrback '771. Applicant traverses these rejections on the basis that amended Claim 1 is patentable over Rohrback '771 and in further view of Rohrback '348. Although Rohrback '771 teaches a substrate that is "resistant to high temperatures" the requirements necessary to make corrosion rate measurements within a boiler or at extremes of temperature and pressure are not addressed therein. The present invention teaches a method and system for determining a corrosion rate under fireside conditions. The innovations required to make measurements under these conditions are not obvious from the teaching of Rohrback '771 or from Rohrback '348. At column 1, line 20 of Rohrback notes that "to eliminate the effects of temperature changes, the sensing element is combined with a reference element

usually composed of the same metal as the sensing element and located in the environment at a position where it experiences the same temperature changes as the sensing element. However, the reference element is coated with or otherwise protected against the effects of corrosion while the sensing element is not." For this approach to function properly, both the passive sensing and reference elements must be in thermal equilibrium with the local environment to allow the effects of corrosion on the sensing element from the reference element. If the temperatures of the sensing and reference elements are not the same, differences in resistance cannot be used to infer a rate of corrosion. Within a boiler, at any point on the surface of a boiler tube temperature and radiative heat load vary rapidly and randomly. In addition, in the fireside environment, the surface of a boiler tube can accumulate solid, semisolid, and molten residue at any time (usually airborne coal ash).

As such, in a fireside environment, the approach of Rohrback '771 to corrosion rate measurement fails Rohrback teaches that the sensing element and reference element must be in thermal equilibrium with each other and with the local environment, i.e. with the surface of a boiler tube. However, under fireside conditions, temperature and radiative heat load vary rapidly and randomly at the surface of a boiler tube. This leads to a requirement that the coupon of the design taught in Rohrback '771 holding both elements be very small, so that both elements experience the same conditions at the same time while both remain permanently attached to a boiler tube (to provide overall thermal stability). Unfortunately, for a small sensor similar to that taught by Rohrback '771, fouling from slag or ash cannot be avoided. Indeed, such fouling could completely cover the small sensor and render moot the measurement of a corrosion rate. Rohrback neither teaches nor suggests a coupon that has "long and narrow" resistive elements, both of which are instantly exposed to the same thermal environment, even under high variable heat fluxes. As such, Applicant submits that Claims 1 and 14 are patentable over the cited prior art.

The Examiner rejects Claims 11 and 12 under 35 U.S.C. §103(a) as unpatentable over Rohrback '771 in view of Schmidt, asserting that it would have been obvious to pass a current through both resistors 11, 12 of Rohrback '771 because Schmidt (clearly) teaches using a generator to pass the same current through resistors to monitor corrosion

and further rejects Claim 13 under 35 U.S.C. §103(a) as unpatentable over Rohrback '771 in view of Schmidt and in further view of Rohrback '348, asserting that the resistors 32 and 33 in Rohrback '348 are dimensionally similar and thus suggestive of the use of similar size resistors in Rohrback '771.. Applicant traverses this rejection based on the arguments provided above. As shown in Fig. 1, 2, and 3 of Rohrback '771, the coupon disclosed therein is substantially oblong. Though it is longer than it is wide, the width of the reference and corroding elements are shown to be substantial relative to the length of the probe. Rohrback '771 is silent with respect to the dimensions. However, the Examiner has relied on approximate dimensions shown therein to argue that Claim 13 is unpatentable. Applicant notes that Rohrback et al. at column 3, line 21-23, makes reference to the "pattern indicated" in Figure 2. Figure 2 shows a reference and corroding element position side by side on an elongated coupon. The reference element occupies approximately half of the coupon while the corroding element occupies the other half. No teaching or suggestion is provided in Rohrback '771 that would direct one 14 of ordinary skill in the art to modify the design of the coupon disclosed therein to produce the coupon of the present invention in which "changes in the resistance of said first and second element as a function of temperature are identical even when said coupon is exposed to high, variable heat fluxes in said hostile environment." Applicant therefore 18 submits that Claim 11 and dependent Claim 12 are in condition for allowance.

The Examiner rejects Claims 10/1, 15, 20/15, 21/15, 16, 20/16, and 21/16 under 35 U.S.C. §103(a) as unpatentable over Rohrback '771 in view of Caldecourt, and Claim 10/2 over Rohrback '771 in view of Rohrback '348 and in further view of Caldecourt, stating that it would have been obvious to employ both sides of the substrate in Rohrback '771 because Caldecourt teaches positioning resistors on opposite sides of a substrate resulting in a smaller sensor. Applicant traverses this rejection on the basis that the Examiner has failed to establish a valid *prima facie* basis for an obviousness rejection. As noted above in response to the previous arguments, neither Rohrback '771 nor Rohrback '348 teach the use of corroding and reference resistors that are long and narrow and very close to each other throughout their path on the substrate. Caldecourt does not teach or suggest this limitation either. As such, no motivation is provided to modify or combine the cited references to produce the claimed invention. Applicant therefore

submits that Claims 10/1, 15, 20/15, 21/15, 16, 20/16, and 21/16 are in condition for allowance.

In view of the foregoing amendment favorable action is respectfully requested.

Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The attached page is captioned "Version with markings to show changes made."

The Commissioner is hereby authorized to charge any other fees determined to be due to Deposit Account 50-2319 (Order No. A-69489/AJT).

Respectfully submitted,

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Version with Markings to Show Changes Made

In the Claims:

Amend the claims as follows. All pending claims are listed below, whether amended or not, for the Examiner's convenience.

1. (amended) A coupon used for measuring corrosion rates of material exposed to a hostile environment comprising:

a substrate,

a first long and narrow thin film resistive element carried on such substrate and exposed to the hostile environment, and

a second long and narrow thin film resistive element carried by said substrate and shielded from the hostile environment, said first and second thin film resistive elements being positioned so that [they are subjected to essentially the same temperature] they are close enough to each other throughout their paths to experience substantially the same thermal environment, such that changes in the resistance of said first and second element as a function of temperature are identical even when said coupon is exposed to high, variable heat fluxes in said hostile environment.

2. (unchanged) A coupon as in claim 1 in which said thin metal elements are composed of a material which has substantially the same resistance before being subjected to a corrosive environment.

3. (unchanged) A coupon as in claims 1 or 2 in which the substrate is an insulator.

4. (unchanged) A coupon in as in claim 1 in which the substrate is a ceramic.

5. (unchanged) A coupon as in claim 4 in which the ceramic is beryllium oxide.

9. (unchanged) A coupon as in claim 2 in which said material forming the thin films is a metal or metal alloy.

10. (unchanged) A coupon as in claims 1 or 2 in which said first and second resistive elements are on opposite sides of the substrate and the substrate is thermally thin.

11. (amended) A system for measuring the corrosion rate of metals in a hostile environment comprising a coupon including:

a substrate; [,]

a corrosive long and narrow thin film metal resistive element carried on said substrate for exposure to the hostile environment; [, and]

a second reference long and narrow thin film metal resistive element carried on substrate shielded from the hostile environment, said first and second thin film elements positioned on said substrate [to be subjected to essentially the same temperature] close enough to each other throughout their paths to experience substantially the same thermal environment, such that changes in the resistance of said first and second element as a function of temperature are identical even when said coupon is exposed to high, variable heat fluxes in said hostile environment; [,]

means for driving a current I through said first and second thin film metal elements; [,]

means for measuring the voltage VC generated across said corrosive thin film metal elements and the voltage VR generated across said reference thin film element by the current flowing therethrough; [,] and

means for processing said current and voltages to provide a measure of change in resistance of the corrosive thin film metal element.

12. (unchanged) A system as in claim 11 including means for continuously receiving resistance difference to indicate the progression of corrosion.

13. (unchanged) A system as in claim 11 in which said thin film metal elements are deposited so as to have essentially the same resistance before corrosion of the corrosive element.

14. (amended) A coupon for use in measuring the corrosion rate of metals exposed to a high-temperature hostile environment comprising:

a substrate; [,]

a first thin long and narrow elongated strip of metal or metal alloy adapted to be exposed to the hostile environment carried by said substrate; and [,]

a second thin long and narrow elongated strip of the same metal or metal alloy as the first carried by the substrate and shielded from the hostile environment but positioned on close enough to said first element to experience substantially the same thermal environment as said first element, such that changes in the resistance of said first and second element as a function of temperature are identical even when said coupon is exposed to high, variable heat fluxes in said hostile environment; [exposed to the substantially the same high temperature as the first elongated strip of metal or metal alloy].

15. (unchanged) A coupon as in claim 14 in which the substrate is thin and the first and second elongated strips are on opposite faces of the substrate whereby the second elongated strip is shielded from the hostile environment by the substrate.

16. (unchanged) A coupon as in claim 15 wherein the second elongated strip is further shielded by an oxide film on its exposed surface.

20. (unchanged) A coupon as in any of claims 14, 15, or 16 in which the substrate is a ceramic.

21. (unchanged) A coupon as in any of claims 14, 15, or 16, in which said substrate is a metal with an oxide insulating and protective film.

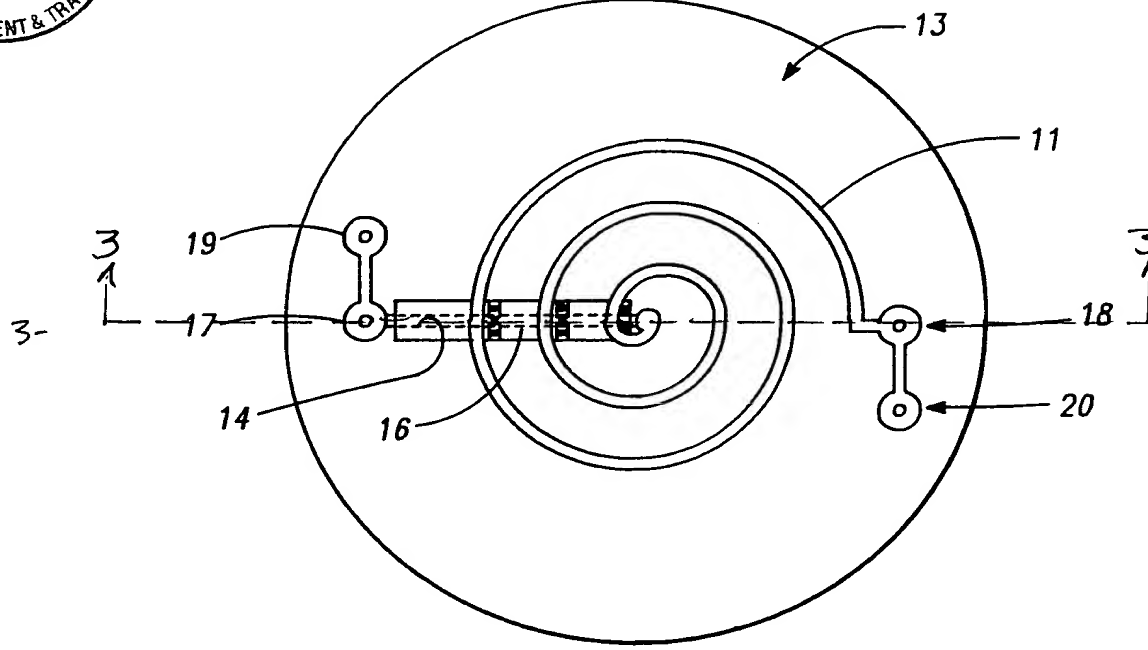

FIG.—1

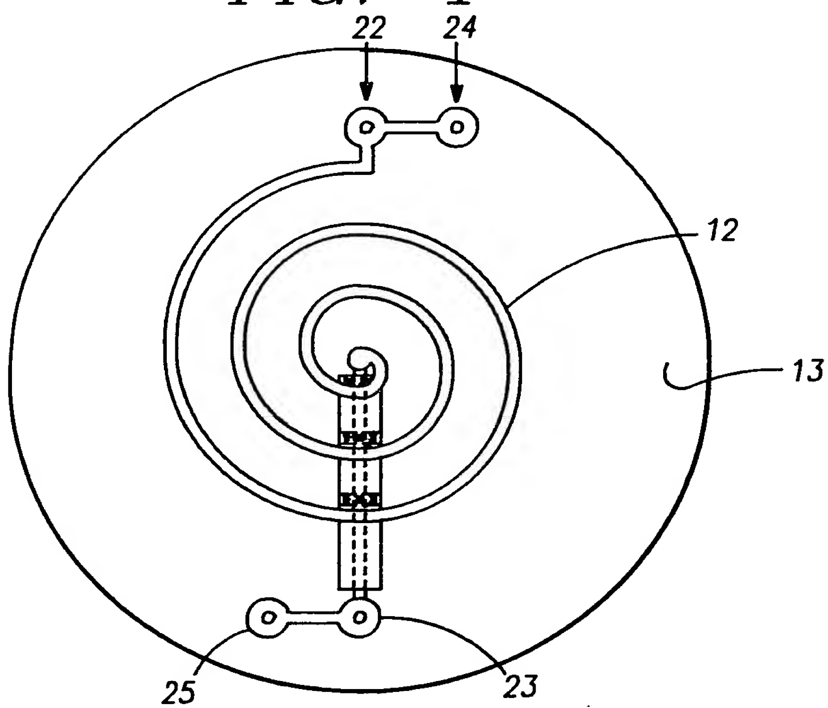

FIG.—2

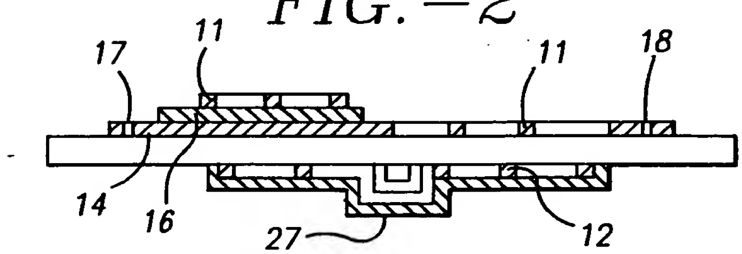

FIG.—3